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ABSTRACT

This paper reports the results of two separate, but related analyses. The first describes trends in the number of college graduates who obtained teacher certification, and changes over the decade in the distribution of new certificants' demographic characteristics, subject specialities, and score on the National Teachers Examination (NTE). The second examines whether demographic characteristics, subject specialties, and NTE scores predict which certificants became teachers in North Carolina public schools and which did not. One objective of the study was to learn the extent to which certification and entry trends were responsible for the decline in the percentage of the nation's black school teachers. Three patterns were discovered: (1) not only was the number of new certificants sensitive to the demand for classroom teachers, but also their choices of subject field was sensitive to demand; (2) there was a difference between blacks and whites in the relationship between NTE scores and the probability of entry into teaching in North Carolina; and (3) the predicted probability of entry into teaching in North Carolina increased over the decade for black certificants while it declined for white certificants. References are included and data gathered from the study are displayed in tables. (JD)

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WHO BECAME CERTIFIED TO TEACH, AND WHO ENTERED TEACHING BETWEEN 1975 AND 1985: EVIDENCE FROM NORTH CAROLINA

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Two troubling facts are at the heart of current discussions about who will staff the schools in the years to come:

-- the number of college students preparing to teach in elementary and secondary schools declined dramatically over the 1970s and early 1980s;[1]

-- a large percentage of the college graduates certified to teach do not enter teaching, or at least do not teach in the state that provided their initial certification (Massachusetts Institute for Social and Economic Research, 1987).

While these two patterns have been widely reported, almost no research has explored whether there have been changes over the last decade in the backgrounds or subject specialties of those college graduates who did train to teach, or whether there are particular characteristics of college graduates certified to teach that predict who became a teacher, and who did not. Such research would provide information about the characteristics of the college graduates who have joined the teaching force in recent years, and about the composition of the elusive reserve pool -- college graduates trained to teach, but not currently teaching.

This paper reports the results of two separate, but related analyses. The first describes trends in the number of college graduates who obtained teacher certification (certificants), and changes over the decade in the distribution of new certificants' demographic characteristics, subject specialties, and scores on the National Teachers Exam (NTE). The second examines whether

demographic characteristics, subject specialties, and NTE scores predict which certificants became teachers in North Carolina public schools (entrants), and which did not.

Our interest in the NTE scores stems from previous research indicating that college graduates with high scores on standardized tests such as the Scholastic Aptitude Test (SAT) are less likely to go into teaching than are graduates with lower scores (Schlechty and Vance, 1983; Weaver, 1983).[2] We wanted to learn whether there was a negative relationship between NTE scores, which are positively correlated with scores on other standardized tests such as the SAT (Ayers and Qualls, 1979; Hall, 1964; Pratt, 1979; Wexler, 1975), and the probability of entry into teaching for college graduates <u>who obtained teacher certification</u>. Finally, we wanted to learn whether the relationship differed, according to the certificant's subject specialty and race.

In addition to the general motivation of increasing knowledge about how teacher labor markets work, we also wanted to explore the extent to which certification and entry trends were responsible for the decline in the percentage of the nation's school teachers who are Black (Graham, 1987; Darling-Hammond, Pittman, and Ottinger, 1987). In particular, we wanted to learn whether this decline is due, in part, to a decline in the proportion of Black certificants who became teachers.

THE NORTH CAROLINA DATABASE

Our database, which was constructed from computerized records made available by the North Carolina Department of Public Instruction, provides information on every person who obtained certification to teach in North Carolina between 1975 and 1985. The information includes demographic characteristics, field of certification, and employment record within the North Carolina public school system. We focused our analyses on the 47,403 persons who were classified as either Black or White and who had no teaching experience prior to obtaining certification in North Carolina.[3]

In all analyses we divided certificants of each race into the following four age and gender groups (with age defined as of certification date): females $\leq$ 30, females $\geq$ 31, males $\leq$ 30, and males $\geq$ 31. We adopted these categories because preliminary data analysis revealed that they captured important trends in the age-gender distribution of new certificants.

In our analyses we used scores on a portion of the NTE which measures knowledge of subject specialty. The reason for this choice is that only scores on the subject-specific subtests are available for most persons who became certified after 1982.[4] When interpreting the information which we present on test score trends, it is important to keep in mind that scores are not comparable across subject-specialty tests.

We want to make clear that we do not view certificants' scores on the NTE as a reliable indicator of potential teaching

"effectiveness." The reason is that correlations between teachers' NTE scores and measures of their effectiveness in teaching students are quite low (Haney, Madaus, and Kreitzer, 1987). We even found one study that shows a negative relationship between teachers' NTE scores and students' achievement gains (Summers and Wolfe, 1977).

We conducted all analyses of NTE scores separately for White and Black certificants. The reason is that, on average, Blacks score much lower on this test than do Whites, and there is evidence that the scores provide different information about the skills of Black college graduates than they do about the skills of White college graduates (Haney, Madaus, and Kreitzer, 1987).

NEW CERTIFICANTS

Number of certificants

As Figure 1 indicates, the number of college graduates who obtained initial teacher certification in North Carolina declined steadily from a total of 6538 in 1975 to 2830 in 1985. This decline, which parallels a national trend, was caused primarily by college students' responses to the incentives they faced. The key causal force reducing the attractiveness of teaching was the decline in school enrollments. This decline reduced the number of teaching vacancies, and consequently reduced the probability that a newly certified teacher would be able to find a teaching position. By reducing the demand for teachers, the enrollment decline also contributed to the decline

in teaching salaries relative to the starting salaries paid by business and industry to college graduates. In 1975, the average starting teaching salary in North Carolina was 97% of the average starting salary paid by business and industry in the U.S. to college graduates trained in the humanities; in 1984, the comparable figure was 79%.[5]

Race

There are two important differences between the trends in the number of Black and White college graduates who obtained certification. First, while the number of new White certificants in 1985 was 47% of the number who obtained certification in1975, the comparable figure for Black college graduates was 24%. Thus, one factor which contributed to the decline in the percentage of minority teachers was the extraordinarily rapid decline in the number of Black college graduates who obtained teacher certification. This rapid decline was not the result of a decline in the number of Black students who graduated from North Carolina colleges and universities. In fact, the number who graduated in 1985 (3686) was virtually identical to the number who graduated in 1977 (3700). Instead, the rapid decline stemmed from the decisions of Black college students to specialize in fields other than education. This pattern is suggested by trends in the proportion of Black college graduates who majored in education (the major typically chosen by graduates intending to obtain certification to teach elementary school). In 1977, 29% of Black graduates from North Carolina colleges and

universities had this major; in 1985, the comparable figure was 14%. (The comparable numbers for White college graduates were 18% in 1977 and 10% in 1985).*

A second difference between Blacks and Whites concerns the timing of the decline in the number of new certificants. As indicated in Figure 1, the number of new White certificants declined almost linearly and without interruption between 1975 and 1981. The trend for Blacks was quite different. Between 1975 and 1978, the number of Black college graduates who obtained teacher certification in N.C. remained almost constant. Since the number of White certificants was falling, the percentage of new certificants who were Black increased from 17% to 19% over this period. After 1978, the number of new Black certificants declined precipitously; by 1981 only 10% of new certificants were Black. In the years between 1981 and 1985 the rate of decline in the number of new Black certificants was similar to the rate of decline in the number of new White certificants; consequently, the proportion of new certificants who were Black remained steady at approximately 10%.

Why did the number of Black certificants decline so rapidly between 1978 and 1981? At least part of the answer concerns the suspension, between August 1975 and April 1977, in the certification requirement that applicants take the NTE and achieve a score above a prespecified level. Suspension of this requirement made it easier to obtain teacher certification in that applicants did not need to spend the time and money to take

the NTE, nor worry that their score would not be above the cutoff. Seventy-two percent of the Black college graduates who obtained teacher certification in 1976, the one full year in which there was no NTE requirement, did so without taking the NTE. The comparable percentage for White graduates is 40. Consequently, it appears that the relatively large representation (18.9%) of Black college graduates among new certificants during the years 1975-77, the first years for which we have data, may reflect a response to the suspension of the NTE test requirement. Unfortunately, we do not have data for the years prior to 1975, and cannot verify that the percentage of certificants who were Black was lower in the years prior to the interruption of the NTE requirement than it was during the period 1975-77.

Age and Gender

The most important change over the decade in the age and gender distributions of new certificants was the increased representation of people age 31 or more at the time they became certified. As displayed in Table 1, women who were over 30 years of age when they obtained certification constituted 5.7% of the population of new certificants in 1975, and 14.0% in 1985. The comparable percentages for men over 30 were 1.3 and 3.9. One indication of the growing representation of men and women over 30 years of age in the pool of new certificants is that, although the number of men and women 30 and under who obtained certification decreased from 6052 to 1827 between 1975 and 1985,

a decline of 70%, the number over 30 increased from 458 to 494 during that period.

One factor which contributed to the changing age structure of the new certificants' pool was the change in the age structure of the population. Between 1975 and 1985 the percentage of the U.S. population between the ages of 30 and 54 grew from 28 to 31.[7] This change does not appear to be large enough, however, to account fully for the increase in the representation of people over 30 in the pool of new certificants. Thus, the pattern suggests that the attractiveness of teaching diminished more for college graduates in their 20s than it did for older graduates.

Subject Specialty

The 47,403 college graduates who obtained initial teacher certification in North Carolina during the decade 1975-85 are distributed across 12 subject specialties.[8] As indicated in column 2 of Table 2, by far the largest specialty in 1975 was elementary education, followed by physical education, social studies, and English. The subject specialties with the smallest number of certificants were business, foreign languages, and chemistry/physics.

The distribution of certificants among subject fields did not remain constant over the decade. While the number of certificants in all fields declined, the rate of decline differed considerably across teaching fields. As indicated in Table 2, the percentages of new certificants who specialized in certain fields, most notably special education, were considerably higher

in 1985 than in 1975, while the percentages of certificants who specialized in other fields, especially business and social studies, were much lower in 1985 than in 1975.

An important reason why the distribution of certificants among subject specialties changed between 1975 and 1985 is that job opportunities in some teaching fields declined more rapidly than job opportunities in other teaching fields. Many college students preparing to teach evidently paid close attention to potential opportunities when they chose a field of teaching specialization. As we discuss below, special education is the field in which the highest percentage of certificants entered teaching in North Carolina. Business and social studies had the lowest entry probabilities. In other words, the evidence suggests that college students not only compared opportunities in teaching with those in other fields when they decided whether to train to teach, they also evaluated potential opportunities in alternative subject specialties when they chose a field of teaching specialization.

Since a theme of this paper is that the distribution of certificants among subject specialties was influenced by the incentives college students faced, it is important to be clear about the nature of this assertion. The claim is not that all students, or even a majority of students paid close attention to opportunities in different fields when choosing a field of study. The claim is only that enough students paid attention to

opportunities to make the overall distribution of certificants among subject specialties responsive to changes in incentives.

NTE Scores

Table 3 displays the mean NTE scores by subject field in 1975 and 1985 for certificants of each race. It indicates that there were almost no large changes between 1975 and 1985 in the average NTE scores for White teachers. In fact, the average NTE score in 1985 was within 15 points of the average score in 1975 for certificants in 11 of the 12 subject fields. (The largest difference, 25 points, was for certificants in business.) In contrast, there were increases of 20 to 70 points in the average NTE scores for new Black certificants in 9 of 11 subject areas.[9] Particularly large increases were present for music teachers, foreign language teachers, and English teachers.[10] The increases in the average NTE scores of Black certificants at least partly reflect increases over the decade in the minimum scores required for certification.

AMONG NEW CERTIFICANTS, WHO ENTERS TEACHING

Forty-one percent of the college graduates who became certified to teach in North Carolina between 1975 and 1985 did not teach in public schools in that state in any year up to and including the 1985-86 school year. In this section, we describe the extent to which race, demographic characteristics, field of specialization, and NTE score predict which certificants entered teaching and which did not. Before turning to the results, it is

important to clarify how we conducted our investigation and how the results should be interpreted.

Analytical Framework

We used maximum likelihood logistic regression analysis to model the relationship between entry into teaching (the dichotomous outcome variable) and the characteristics of each teacher's background and training (the predictors).[11] The advantages of this approach are three fold. First, it permitted us to investigate entry as a function of particular predictors, such as subject specialty, while controlling for other variables, such as age and gender. Second, logistic regression analysis permits the formal testing of hypotheses concerning the influence of specific predictors. For example, we tested whether certificants specializing in mathematics were more likely to enter teaching than certificants trained in social studies. Third, with logit analysis, a predicted value of the outcome variable is a probability that an individual with particular characteristics will enter teaching. This provides a simple strategy for interpreting the findings.

We estimated four series of models for the samples of White certificants and Black certificants. The first models predicted entry as a function of age, gender, and the year in which certification was obtained. The second models predicted entry as a function of certification year and subject specialty. The third group of models included predictors of entry age, gender, year of certification, and subject specialty. The fourth group

of models, which we estimated separately for certificants in each subject field, predicted entry as a function of age, gender, certification year, and NTE score. In estimating each group of models, we tested for the presence of interactions among the predictors, and report those interaction effects that were statistically significant.

Understanding the Results

In interpreting our findings, keep in mind that there are two categories of reasons why an individual in our sample did not teach in North Carolina. The first category includes "supply" reasons: The person chose not to supply his or her services to a North Carolina public school, instead choosing to work elsewhere, perhaps in another field entirely, or perhaps in a school in another state, or even perhaps in a private school in North Carolina. The second category includes "demand" reasons: The person was not offered a position in a North Carolina public school. While it would be valuable to distinguish factors influencing supply from those influencing demand, this is not possible with our data. Instead, we can only observe the outcome of the interaction of demand and supply -- namely, who taught in North Carolina public schools and who did not. A consequence of this limitation is that our results inevitably raise questions about why teachers with certain characteristics were less likely to teach in North Carolina public schools than were other teachers. We cannot answer these questions definitely, although

in some cases, we speculate about the answers and explain our reasons.

In thinking about the meaning of the patterns we identify, keep in mind that North Carolina is a net exporter of teachers to other states. Consequently, some certificants who did not enter teaching in North Carolina probably taught in other states. This does not make our analysis uninteresting. In fact, the perspective of the individual state is an important one in thinking about teacher labor markets, since states both establish certification requirements and provide financial support for the public higher educational institutions from which most new certificants graduate. As a result, information about which certificants teach in their home state is highly relevant to state policy. At the same time, the limitations of our data should be kept in mind when interpreting the results discussed below.

Race

Sixty percent of the White college graduates who obtained teacher certification during the 1975-1985 period entered teaching in North Carolina. The comparable figure for Black certificants is 55%. These averages for the decade are deceptive, however, because the estimated probability of entry for White certificants decreased over the decade from .64 in 1975 to .54 in 1985, while the estimated probability of entry for Black certificants increased from .54 to .58 over this period. These differing trends are displayed in Figure 2.[12]

One inference to be drawn from these patterns, if they hold nationally, is that the declining proportion of Black teachers in the teaching force is not due to a decline in the percentage of Black certificants who become teachers. Instead, one must look to other steps in the pipeline to explain this disturbing trend, most notably to the decline in the percentage of Black college students who choose teacher training (cf. Darling-Hammond, Pittman, and Ottinger, 1987).

Age and Gender

Table 4 presents the estimated entry probabilities in 1975 and 1985 for certificants of each race in each of four age-gender groups.[13] For both White and Black certificants, the predicted entry probabilities were considerably higher for women than for men in 1975. However, the estimated probability of entry for White women declined dramatically over the decade, while the estimated entry probability for White men increased. As a result, in 1985, only nine percentage points separated the highest predicted entry probability among White certificants (for females $\geq$ 31 and males $\leq$ 30) and the lowest predicted entry probability (for females $\leq$ 30). A likely explanation for the declining entry probability of White women is that improved job opportunities in relatively high paying fields outside of education attracted an increasing proportion of this group to other occupations.[14]

The entry trends of Black certificants differ in important respects from those of White certificants. As was the case with

White males, the estimated probability of entry for Black males increased over the decade. However, in contrast to the declining probability of entry for White females, the predicted entry probability of Black females increased slightly over the decade. The result of these trends was that, while in 1975 the predicted entry probability for Black certificants in each age-gender group was lower than the entry probability for White certificants in the comparable demographic group, by 1985 the predicted entry probabilities were very similar. The one exception was that, in 1985 the predicted entry probability for young Black women was 8 points higher than the predicted entry rate for young White women.

Subject Specialty

As indicated in Table 5, which presents predicted entry probabilities in 1975 and 1985 for White certificants and Black certificants with particular subject specialties, teaching field is an important predictor of the probability of entry into teaching.[15] For example, in 1975 the predicted entry probability of certificants of either race whose field was special education was more than twice as high as the entry probability for certificants of the same race whose field was business education.

The predicted entry probabilities in Table 5 also display particular patterns that throw light on the way the teacher labor market operated in North Carolina between 1975 and 1985. First, for both Black and White certificants, the predicted entry probabilities declined in those fields in which a large

proportion of the 1975 certificants became teachers in North Carolina (special education and elementary education). At the same time, the predicted entry probabilities increased in those fields in which in which a small proportion of 1975 certificants taught in the state (physical education, social studies, and business). The reason is that college students who prepared to teach paid attention to job prospects when they chose a field of specialization. For example, as displayed in Table 2, the proportion of new certificants who chose the field of special education increased from 6.9% in 1975 to 13.0% in 1985. The increased competition for jobs in this field contributed to a reduction in the predicted entry probability. The proportion of new certificants who chose business decreased from 3.1% in 1975 to 1.3% in 1985, and the proportion who chose social studies declined from 10.0% to 5.6% over the same period. These responses reduced the competition for available jobs, and led to increases in the probability that certificants in those fields entered teaching in North Carolina.

A second pattern evident in Table 5 is the increase in the predicted entry probabilities of certificants from both races who specialized in mathematics and the sciences. In 1975 the predicted entry probabilities for White certificants in mathematics, biology, and chemistry/physics were .65, .61, and .59, respectively. In 1985, the respective entry probabilities in these fields were .71, .64, and .62. The increases in the predicted entry probabilities for Blacks certified in mathematics

and biology were even greater.[16] The increases in predicted entry probabilities for certificants specializing in mathematics or science were not the result of especially rapid declines in the supply of new certificants in these fields. In fact, as indicated in Table 2, the percentages of new certificants with these specialties increased over the decade -- from 4.1% to 5.0% for mathematics, from 3.5% to 4.9% for biology, and from 0.6% to 0.8% for chemistry/physics. Thus, the explanation appears to lie with increases in the demand for teachers in these fields.

A third pattern is that in virtually every subject field, the predicted entry probability of Black certificants increased over the decade relative to the predicted entry probability for White certificants. In 1975 the predicted entry probability for White certificants was higher than the predicted entry probability for Black certificants in most fields. In 1985 there was only one field (business) in which this was the case. In many fields, including elementary education, English, and social studies, the predicted entry probability for Black certificants in 1985 was considerably higher than the predicted entry probability for White certificants.[17]

NTE Scores

Relationships between college students' test scores and their career paths in teaching have attracted considerable publicity in recent years, largely because studies have reported that college graduates with low scores on standardized tests are more likely to enter teaching, and are inclined to stay longer in

teaching than are graduates with high scores (compare, for example, Weaver, 1983; Schlechty and Vance, 1983). In our analyses of the relationship between NTE score and the probability of entry into teaching, we wanted to explore differences that might be present across races, demographic groups, and subject specialties. This led us to conduct all analyses of the relationship between entry into teaching and NTE scores separately for Black and White certificants. We tested whether the relationship between entry and NTE score differed by demographic group. Since no such interaction effects were discovered, we display the predicted NTE probabilities by NTE score for women aged 30 or less, the largest demographic group. We also found no interactions between NTE score and certification year, in the prediction of entry, so we estimated entry probabilities for 1980, the middle year of the time period covered by our data.

We conducted separate analyses for each subject field because it seemed plausible that the relationship between entry and NTE score could differ among subject specialties. Such differences might exist both because the opportunities outside of teaching for certificants with high NTE scores varied by subject field, and because school districts might employ different criteria in hiring teachers in different fields. This decision also enabled us to include data on teachers who became certified in the years 1983-85; for these years only scores on the NTE subject specialty tests were available.[10] Of course, one

consequence of using the subject-specific NTE scores, which are not scaled to a common metric, is that we cannot carry out statistical tests to determine whether NTE score has a greater influence on the probability of entry for certificants with certain subject specialties than for certificants with other specialties.

We adopted two criteria for deciding whether there was a meaningful relationship between entry into teaching and NTE score for certificants in a particular subject area. First, we had to reject at the .10 level the null hypothesis that NTE score did not predict entry. Second, an increase in the NTE score from the 10th percentile of the sample score distribution for certificants to the 90th percentile had to correspond to a change in the predicted entry probability of more than 5 percentage points.[19] These criteria were satisfied for White certificants in three subject fields, and for Black certificants in seven fields. Table 6 displays the predicted entry probabilities by subject field and race for certificants whose scores on the NTE corresponded to the 10th and 90th percentiles of the sample test score distribution for that race. The predicted entry probabilities are presented only for those subject areas that met the two criteria for inclusion.

Consider first the predicted probabilities of entry for White certificants. In three fields, mathematics, chemistry/physics, and English, NTE score is a strong predictor of the probability of teaching in North Carolina schools. In all of these fields

certificants with high scores had a lower probability of entry than certificants with low scores. The likely explanation for the negative relationship between probability of entry and NTE score is that the most academically able certificants in these fields were pulled to financially attractive jobs either outside of teaching, or to teaching jobs in states with higher salaries than North Carolina's. It is important to note, however, that in 9 of the 12 fields of specialization, NTE score as not an important predictor of the probability of entry into teaching for White certificants.

The relationships between entry and NTE score for Black certificants are very different from the relationships for White certificants. In all seven fields in which a Black certificant's NTE score is an important predictor of entry, certificants with high scores had a higher predicted probability of entry than certificants with low scores.

The likely explanation for the strong positive relationship between NTE score and the entry probability for Black certificants is that a large percentage of certificants with low scores on the NTE were not offered teaching positions in North Carolina public schools. A possible complementary explanation is that Black certificants with relatively high scores did not experience as attractive job options in other fields as high scoring White certificants did.

Certificants Without NTE Scores

During the period from August 1975 to April 1977, the NTE score requirement for certification in North Carolina was suspended, and many college graduates obtained teacher certification without taking the NTE. Comparisons between the predicted entry probabilities of certificants who took the NTE and certificants who did not take the NTE revealed a consistent pattern: Those certificants who did not take the NTE were much less likely to become teachers in North Carolina than were certificants of the same race in the same field who did take the test.[20] There are two complementary explanations for this consistent pattern. First, elimination of the NTE requirement made the process of obtaining teacher certification less onerous and less costly. As a result, many college graduates who had little interest in teaching, at least in the immediate future, may have responded to the temporary waiving of the NTE requirement by obtaining certification with the thought that they might one day want to teach. Second, many school districts in North Carolina require that applicants for teaching positions report their NTE scores on the application form. Districts may have been reluctant to make job offers to applicants without scores.

The interruption of the NTE score requirement contributed to the increase from .54 to .58 in the predicted probability of entry for Black certificants between 1975 and 1985, a period during which the demand for teachers in North Carolina declined.

The reason is as follows. During the years 1975-77, a period that included the 19 months during which the NTE requirement was suspended, 46% of new Black certificants did not take the NTE. (The comparable number for White certificants is 27%.) Since the probability of entry was much lower for certificants who did not take the NTE than for certificants who did take the test, the net effects of the interruption were to increase the number of certificants during the period 1975-77, and to lower the predicted probability of entry below what it otherwise would have been for these years. In fact, the predicted probability of entry for Black certificants who did take the NTE was stable over the period 1975-85 at a level of .60.[21] Thus, the increase in the predicted entry probability between 1975 and 1985 for the full population of Black certificants reflects, to a large extent, the influence of the interruption of the NTE requirement.

EXPLAINING THE TRENDS IN ENTRY PROBABILITIES FOR TEST-TAKERS

In this section we explore why the predicted probability of entry for White certificants who took the NTE declined from .70 in 1975 to .52 in 1985, while the predicted probability of entry for Black certificants who took the NTE remained stable at .60 during this period. For ease of exposition, we refrain from continually stating that the relevant populations are certificants with NTE scores.

The predicted probability of entry for White certificants fell between 1975 and 1985 for two closely related reasons.

First, as a result of a drop in school enrollments, the demand for new teachers fell. Second, the deterioration over the decade in teachers' salaries relative to salaries in other occupations led many new certificants to pursue jobs outside of teaching.

This explanation raises the question of why the predicted probability of entry for Black certificants did not decline over the decade. One reason is that the number of new Black certificants fell more precipitously over the decade than the number of new White certificants did. Thus, to the extent that school districts wanted to fill a certain percentage of teaching positions with Black candidates, the dramatic decline in the number of new Black certificants reduced competition for these positions. A second reason is that the characteristics of new Black certificants changed over the decade such that a larger proportion of new Black certificants in 1985 had the subject specialties and NTE scores that school districts sought than was the case for Black certificants in 1975.

To illustrate the importance of the change over the decade in the distribution of new Black certificants' test scores and subject specialties, we adapted a statistical technique from economics (cf. Oaxaca, 1973) to address the following hypothetical question: What would the probability of entry have been for the population of 1975 Black certificants if it had faced 1985 labor market conditions? The predicted entry probability, .52, was 8 percentage points lower than the predicted entry probability for the population of Blacks

certified in 1985.[22] In other words, the results of this hypothetical experiment imply that the entry probability for 1975 Black certificants facing 1985 labor market conditions would have been approximately equal to the predicted entry probability for White certificants in 1985 (.52).

The reason the predicted entry probability for Black certificants did not fall over the decade is that the distributions of new Black certificants' NTE scores and subject specialties, variables that were important predictors of the probability of entry into teaching, changed over the decade. NTE scores for Black certificants rose (cf. Table 3), and, as discussed above, Black certificants with high NTE scores were more likely to enter teaching in North Carolina than were Black certificants with low NTE scores. The distribution of subject specialties chosen by new Black certificants also changed dramatically over the decade. For example, the proportion of Black certificants who chose the high demand field of special education increased from 3% in 1975 to 14% in 1985. The proportion who chose the low demand field of business decreased from 10% to 4% over the decade. It was these changes in the characteristics of new Black certificants that led to the stable entry probability during a period in which the predicted entry probability for White certificants declined significantly.

When we conducted the analogous hypothetical experiment for White certificants, we found that the predicted entry probability for the population of 1975 White certificants who faced 1985

labor market conditions would have been .51, only 1 percentage point lower than the predicted entry probability for the population of 1985 certificants.[23] In other words, changes over the decade in the distributions of White certificants' NTE scores and subject specialties had much less influence on the predicted probability of entry into teaching than was the case for Black certificants. There are two related reasons for this. First, NTE scores had much less impact on the probability of entry for White certificants than they did on the probability of entry for Black certificants. Second, the changes over the decade in the distributions of subject specialties and NTE scores for White certificants were more modest than the changes in the distributions of Black certificants' subject specialties and NTE scores. For example, the percentage of White certificants who chose the field of special education rose from 6 to 8 between 1975 and 1985, compared to a change from 3 to 14 for Black certificants.

SUMMING UP

We discovered three striking patterns. The first is that not only was the number of new certificants sensitive to the demand for classroom teachers, but also, certificants' choices of subject field were also extremely sensitive to demand. This responsiveness to demand resulted in a large increase in the proportion of new certificants who chose special education as a

subject field, and a marked decline in the proportion who chose business.

Second, there was an important difference between Blacks and Whites in the relationship between NTE score and the probability of entry into teaching in North Carolina. Among White college graduates whose interest in teaching extended at least to the point of obtaining certification, NTE score was not an important predictor of entry for certificants in most subject fields. In the fields where NTE did matter, subjects in which graduates tend to have the most attractive job opportunities outside of teaching, high scoring certificants were less likely to teach in North Carolina than were low scoring certificants. NTE score was a much more important predictor of entry into teaching in North Carolina for Black college graduates certified to teach than for White certificants. In seven of 11 fields of specialization, NTE score was an important predictor of the probability of entry. In all of these fields, certificants with relatively high scores were much more likely to become teachers in North Carolina than were certificants with low scores.

Third, the predicted probability of entry into teaching in North Carolina increased over the decade for Black certificants while it declined for White certificants. A key reason why the probability of entry for Black certificants did not decline was that Black college students responded actively to the incentives they faced. One of the significant incentives was the NTE minimum score requirement. This requirement appears to have

contributed to the extremely rapid decline in the number of Black certificants. It also contributed to the increase in the mean NTE score for those Black college students who did become certified.

One of the implications of this analysis is that attempts to increase the number of Black teachers in the schools should not focus on helping Black college graduates who are certified to teach to find jobs. Black college graduates certified to teach did quite well in finding teaching positions in North Carolina, even during a period of declining enrollments. One reason for their success was the strategic way in which they adapted their choices of subject specialty to demand conditions.

Instead, the pressing challenge is to increase the number of Black college students who choose to train to teach, and who successfully complete the training and obtain teacher certification. Our analysis indicates that reinstatement of the NTE test score requirement in North Carolina had a large negative impact on the number of Black college students who obtained teacher certification in that state. This suggests that one important focus for study should be the implications of using standardized pencil-and-paper tests in general, and the NTE in particular, as part of the teacher certification process. Important questions include:

Do scores on particular subtests of the NTE predict teaching effectiveness? If so, what cutoff scores are justified?

Are there effective ways to train students, especially minority students, to increase their scores on the NTE?

Does training that is effective in raising NTE scores also result in improved classroom teaching?

These are not new questions; indeed, they have been the subject of a considerable amount of research. Yet the answers remain elusive. In the wake of increased use of standardized tests as part of the teacher certification process in many states, these questions deserve renewed attention.

ENDNOTES

1. See Digest of Education Statistics 1987, p. 119, for a chart showing the rapid decline in the number of college students in the U.S. majoring in education. The number of education majors does not provide an accurate count of the number of college students preparing to teach since many graduates with other majors become teachers. However, to our knowledge, no more accurate national count exists.

2. Not all research shows a negative relationship between test score and the probability of entering into teaching. See, for example, Nelson, 1985, and Pavalko, 1970.

3. We excluded from our analysis 9,420 individuals who taught elsewhere before obtaining N.C. certification, and an additional 441 persons of Asian, Native American, or unknown descent.

4. Since most people in our sample who became certified prior to 1983 had taken the general and professional knowledge subtest of the NTE as well as a subject-specific subtest, we could explore whether the predicted relationship between NTE score and probability of entry depended on the choice of test score used in the analysis. We found that none of the patterns we discovered was sensitive to this choice.

5. We compiled the information on teaching salaries in North Carolina from published salary schedules provided to us by the North Carolina Educational Association. The information on starting salaries in business and industry came from College Placement Council reports.

The state of North Carolina provides a basic salary structure for all public school teachers in the state. (Approximately half of the local school districts in the state supplement the state schedule.) The competitiveness of teaching salaries in North Carolina depends critically on the actions of the state legislature. Competitiveness typically improves in those years in which the legislature raises the schedule -- something that it does not do every year. In 1985 the average starting teachers salary in North Carolina was 92% of the average starting salary paid by business and industry to humanities majors. In 1984 and 1986, the comparable numbers were 79% and 83%.

6. The information on the number of students enrolled in North Carolina colleges and universities, the number of students graduating from these institutions, and their academic majors came from the Higher Education General Information surveys (HEGIS), administered by the U.S. Department of Education.

7. See U.S. Bureau of the Census (1987). Statistical Abstract of the United States: 1988 (108th edition), Washington, DC.

8. We used the following procedure to assign a subject specialty to each certificant. First, we assumed that teachers who took the NTE area specialty test were certified in the subject area to which the test pertained. Second, for the minority of certificants who did not take the NTE area test, we assumed that they were certified in the subject of their undergraduate major.

9. The number of Black certificants in Chemistry/Physics (9) was too small to discuss NTE score trends.

10. To verify that the reported trends were not artifacts of atypical average NTE scores for either 1975 or 1985, we calculated for certificants in each subject field the predicted NTE score for 1975 and the predicted NTE score in 1985. These predictions were based on regressions in which the NTE score for individual certificants was the dependent variable, and the certification year was the explanatory variable. We also estimated regressions in which the square of the certification year was included as an explanatory variable. The test scores for 1975 and 1985 predicted from these regressions display the same patterns described in the text.

11. See Chapter 7 of Hanushek and Jackson (1977) for a lucid description of logit analysis.

12. The trends displayed in Figure 2, as well as the estimated entry probabilities for Black certificants and White certificants in 1975 that are reported in the text, are predictions from a logit model. The dichotomous dependent variable, entry, was explained by the certification year, an indicator variable for a Black certificant, and the interaction of the certification year and the race indicator.

13. Separate logit models were estimated for Black certificants and White certificants. Each model included the following explanatory variables: year of certification, indicator variables for age $\geq$ 31 in certification year, female, the interaction of the gender and age variables, and the interaction of gender and year of certification.

14. To explore the extent to which the trends in predicted entry probabilities by demographic groups reflected the concentration of women in particular subject fields, especially elementary education, we predicted entry probabilities from models that included indicator variables for each subject specialty. We also predicted entry probabilities by demographic group from models estimated on the (Black and White) samples of certificants who specialized in elementary education, the largest subject specialty. The results support the patterns described in the

text.

15. The predictions of entry probabilities in 1975 and 1985 for certificants in each subject are based on logit models in which entry is explained by subject specialty, year of certification, and the interaction of subject specialty and certification year.

16. The number of Black college graduates certified in chemistry or physics during the years 1975-85 (9), was too small to make predictions about the trend in the entry probability.

17. To verify that the patterns regarding entry probabilities by subject were not heavily determined by differences in the representation of women in different subject fields (recall the decline in the entry probabilitiy of White women over the decade), we predicted entry probabilities by subject field using models that controlled for demographic characteristics. The predictions support the patterns described above.

18. All of the predicted entry probabilities by NTE score presented in Table 6 are based on logit models that included as explanatory variables each teacher's score on the NTE subject specialty test, the year in which they teacher obtained certification, the teacher's age and gender, and statistically significant interactions among those variables. To explore the possibility of a nonmonotonic relationship between NTE score and entry probability, we also estimated models that included the square of the NTE score. We based predictions on this second model for those subjects in which the coefficient on the squared score was statistically significant.

19. In those models that included a quadratic specification of the NTE score, the relationship between NTE score and probability of entry may be nonmonotonic in the range of legitimate NTE scores. In such cases, it is possible for the probability of entry to vary by more than five percentage points for different values of the NTE score, but still have the probability of entry within five percentage points for the scores at the 10th and 90th percentiles. We found that such a pattern did not occur in our data.

20. The predicted entry probabilities used in the comparisons were based on logit models that were estimated separately for test-takers and non-test-takers of each race. Explanatory variables included the year of certification, indicator variables for the 12 subject fields, and interactions of subject with certification year.

21. The reason that the predicted probability of entry in 1985 for Black certificants who took the NTE (.60) is slightly higher than the predicted probability of entry in that year for the total population of Black certificants is as follows. In the

years after the NTE requirement was reinstated, a relatively small number of college graduates obtained certification without submitting NTE scores. These certificants had a lower probability of entry than did certificants who submitted NTE scores.

22. We used the following method to conduct the hypothetical experiment. First, for the population of Black certificants that took the NTE, we estimated the probability of entry as a function of age, gender, subject specialty, NTE score, certification year and the interactions of gender and subject specialty with certification year, and the interaction of NTE score with subject specialty. (There was no statistically significant interaction between age and certification year, or between NTE score and certification year.) Second, we calculated the average values of age, gender, and subject specialty, and NTE score within each specialty for members of the population certified in 1975. We treated these average values as the values of the "average 1975 certificant." We then used the estimated parameters of the model to predict the probability of entry for the "average 1975 certificant" under the assumption that the value of the certification year was 1985, not 1975.

23. To estimate what the probability of entry would have been had 1975 White certificants faced 1985 labor market conditions, we used the same procedure as the one described in the previous note, except we estimated the model using data on the population of White certificants who took the NTE.

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Figure 1

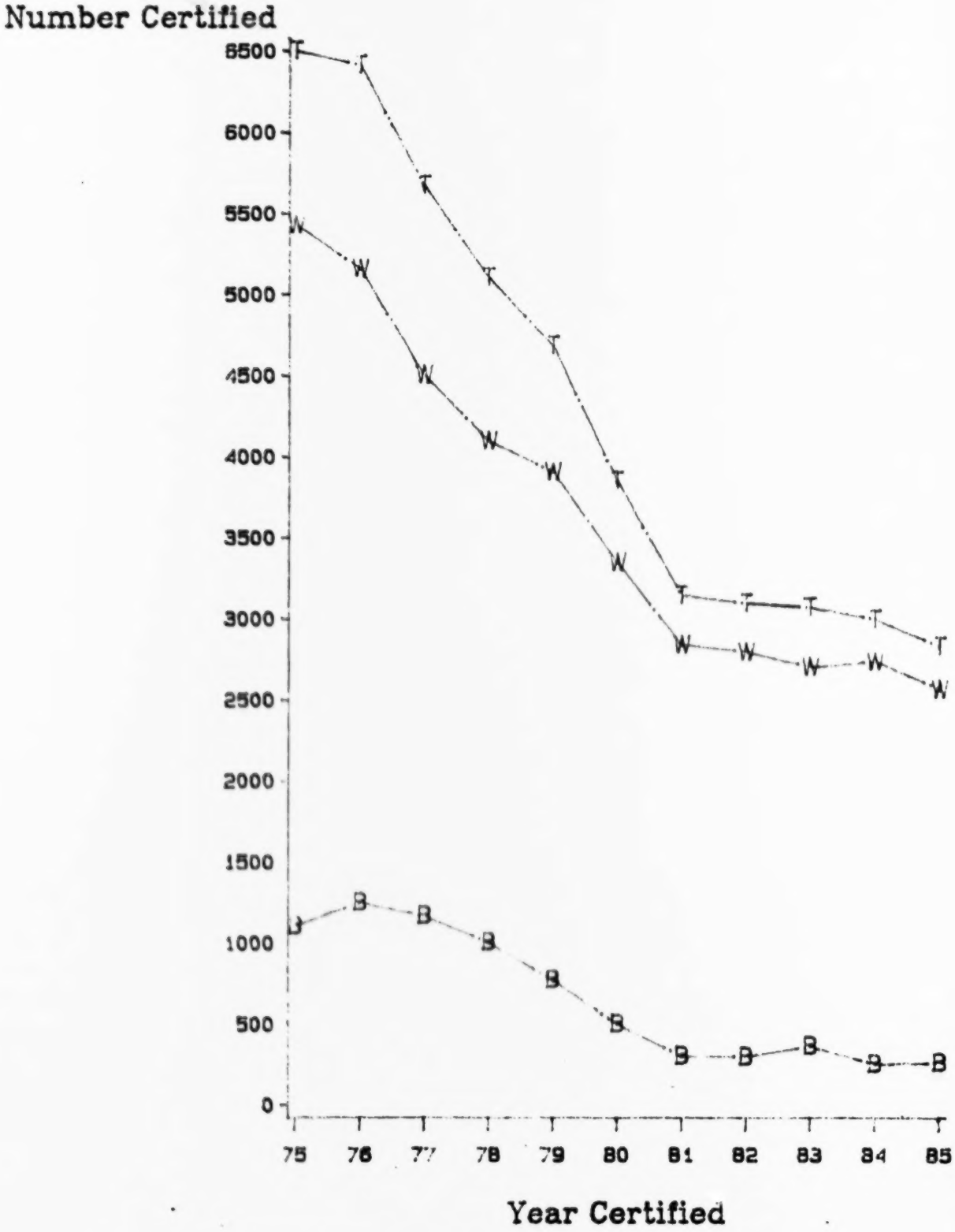
Number Certified
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
75
76
77
78
79
80
81
82
83
84
85
Year Certified
B-B-B BLACKS
W-W-W WHITES
T-T-T TOTAL

Table 1

Distribution of Certificants by Gender and Age

% of Certificants

Gender	Age when certified	1975	1985
Female	≤ 30	70.6	66.4
Female	≥ 31	5.7	14.0
Male	≤ 30	22.3	15.7
Male	≥ 31	1.3	3.9

Table 2

Distribution of Certificants by Subject Field a/

Number and percent of certificants

Subject Specialty	1975		1985	
	N	%	N	%
Elementary Education	2751	(42.1)	1227	(43.4)
Physical Education	715	(10.9)	259	(9.1)
Social Studies	654	(10.0)	158	(5.6)
English	553	(8.5)	193	(6.8)
Special Education	449	(6.9)	367	(13.0)
Music	310	(4.7)	168	(5.9)
Mathematics	268	(4.1)	142	(5.0)
Biology	226	(3.5)	138	(4.9)
Art	216	(3.3)	61	(2.2)
Business	200	(3.1)	37	(1.3)
Foreign Languages	160	(2.4)	57	(2.0)
Chemistry/Physics	36	(0.6)	23	(0.8)

a/ Subjects are arranged in desending order of the number of White certificants in 1975.

Table 3

Sample Mean NTE Score in 1975 and 1985 by Subject and Race

	Whites			Blacks		
	1975	1985	Change btwn. 1975 & 1985	1975	1985	Change btwn. 1975 & 1985
Elementary Education	633	630	-3	522	564	+42
Physical Education	654	639	-15	543	575	+32
Social Studies	611	606	-5	534	536	+2
English	618	623	+5	520	581	+61
Special Education	635	642	+7	558	592	+34
Music	623	622	-1	545	613	+68
Mathematics	625	632	+7	530	552	+22
Biology	669	665	-4	565	578	+13
Art	611	618	+7	526	563	+37
Business	620	645	+25	535	571	+36
Foreign Languages	604	616	+12	558	625	+67
Chemistry/Physics	613	625	+12	b/		

a/ As explained in the text, the scores are not comparable across subjects. The subjects are arranged in descending order of the number of White certificants in 1975.

b/ Only nine Black college graduates became certified in chemistry or physics during the period 1975-1985.

Figure 2

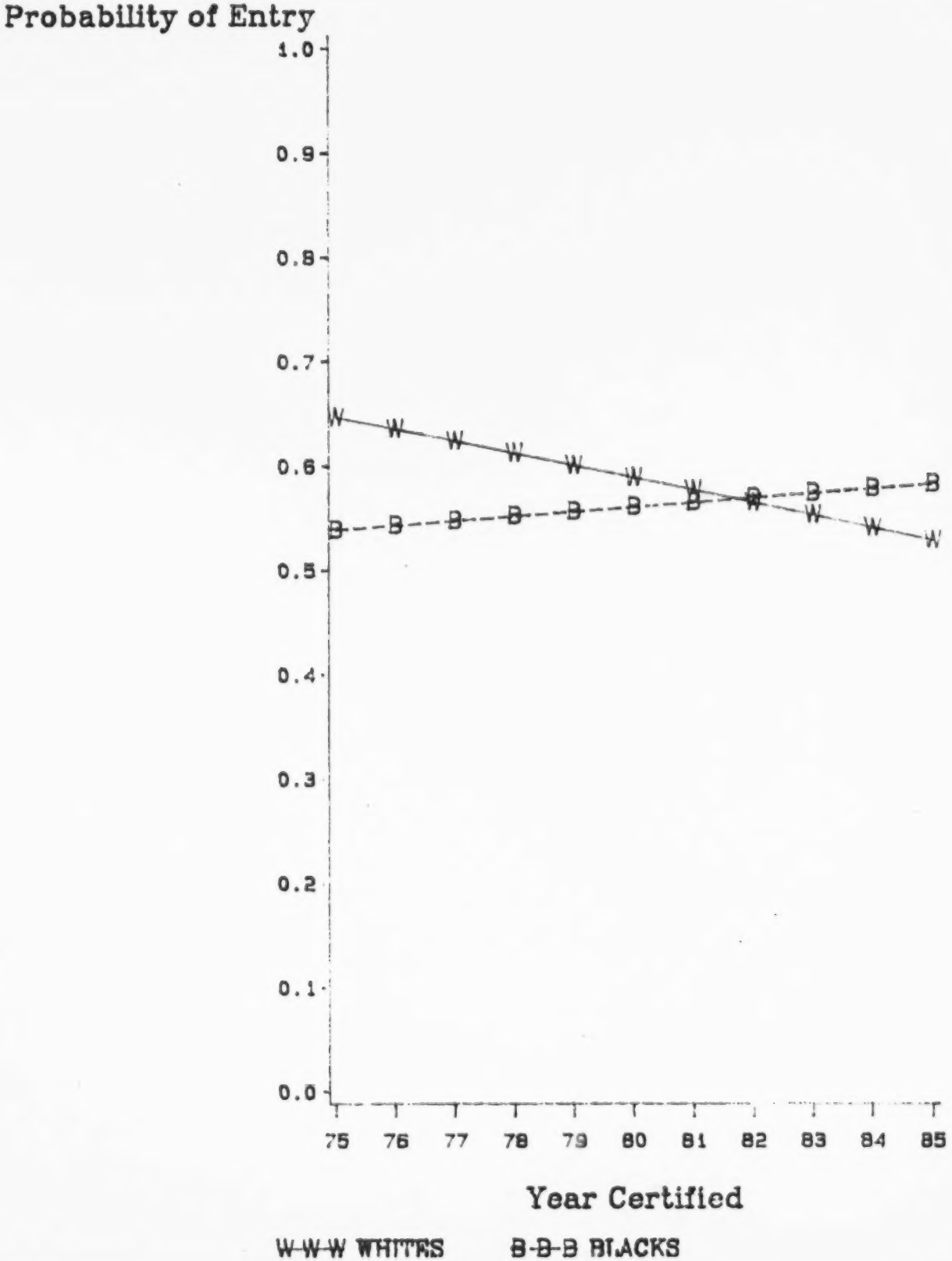
Probability of Entry
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
75
76
77
78
79
80
81
82
83
84
85
Year Certified
W-W-W WHITES
B-B-B BLACKS

Table 4

Estimated Probability of Entry into Teaching in 1975 and 1985

By Age, Gender, and Race

Gender	Age when certified	White Certificants		Black Certificants	
		1975	1985	1975	1985
Female	≤ 30	.68	.51	.56	.59
Female	≥ 31	.70	.57	.58	.60
Male	≤ 30	.51	.57	.47	.58
Male	≥ 31	.42	.48	.36	.47

Table 5

Estimated Probability of Entry into Teaching in 1975 and 1985 by Subject and Race a/

Subject Specialty	White Certificants 1975	White Certificants 1985	Change in Entry Prob. 1975-1985	Black Certificants 1975	Black Certificants 1985	Change in Entry Prob. 1975-1985
Special Education	.81	.58	-.23	.77	.58	-.19
Elementary Education	.77	.51	-.26	.66	.58	-.08
Mathematics	.65	.71	+.06	.57	.77	+.20
Biology	.61	.64	+.03	.56	.67	+.11
Chemistry/Physics	.59	.62	+.03			
English	.57	.51	-.06	.57	.65	+.08
Music	.53	.41	-.12	.35	.45	+.10
Art	.51	.41	-.10	.48	.56	+.08
Foreign Languages	.47	.53	+.06	.59	.68	+.09
Physical Education	.45	.47	+.02	.37	.53	+.16
Social Studies	.43	.49	+.06	.44	.58	+.14
Business	.29	.36	+.07	.15	.24	+.09

a/ The subjects are arranged in descending order of the probability of entry for White certificants in 1975.

Table 6

Predicted Probability of Entry into Teaching for Women Age ≤ 30 by NTE Score a/

Subject Specialty	White Certificants		Black Certificants	
	10th %ile of NTE sample distribution	90th %ile of NTE sample distribution	10th %ile of NTE sample distribution	90th %ile of NTE sample distribution
	Score = 546	Score = 720	Score = 450	Score = 620
Elementary Education			.41	.80
Physical Education			.27	.43
Social Studies			.38	.51
English	.61	.51	.54	.76
Special Education			.50	.78
Music			.36	.56
Mathematics	.78	.61		
Biology			.47	.75
Chemistry/Physics	.71	.58		

a/ Subjects are arranged in descending order of the number of White certificants in 1975.